

**BRACHYNEMURUS NEBULOSUS (NEUROPTERA:
MYRMELEONTIDAE): A POSSIBLE BATESIAN
MIMIC OF FLORIDA MUTILLID WASPS
(HYMENOPTERA: MUTILLIDAE)¹**

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ABSTRACT: Larval *Brachynemurus nebulosus* (Neuroptera: Myrmeleontidae) from Florida exhibit a bold color pattern of orange-red, white and black which resembles that of three sympatric species of mutillid wasps (Mutillidae). When uncovered, *B. nebulosus* larvae run over the substrate in zig-zag dashes, further increasing their resemblance to mutillid wasps. It is suggested that the atypical coloration and behavior of *B. nebulosus* larvae may constitute a generalized Batesian mimicry of at least three of the common species of *Dasymutilla* of the region.

Mutillid wasps, or "velvet ants", are common and conspicuous inhabitants of open, sandy areas throughout the United States. Most display prominent aposematic patterns of red, orange, or yellow and black which often include whitish rings at the tip of the abdomen. This bold coloration and the rapid, zig-zag locomotion characteristic of the wingless females serves as a fair warning to would-be predators of the heavily armored bodies and formidable stings of these insects, the effect of the latter having been likened to a strong electric shock.

While collecting mutillid wasps at the Archbold Biological Station, Highlands Co., Florida, during the spring and summer of 1976, a visiting graduate student collected two specimens of larval antlions which bore a striking behavioral and morphological resemblance to mutillid wasps when viewed from above (Fig. 1). One of these larvae was reared and the imago identified as *Brachynemurus nebulosus* (Oliv.). The color of the head, thorax and anterior abdomen of these larvae in life is bright reddish-orange, while the latter half of the abdomen is boldly marked in black and white. In alcohol, the reddish-orange fades somewhat, but is still quite different from the dull brown and gray color of all other known larvae of *Brachynemurus* (Stange, 1970).

The behavior of the two *B. nebulosus* larvae was unusual in that the larvae would frequently run in abrupt dashes on top of the sand, rather than spending all of their time beneath it as do all other known *Brachynemurus* larvae. If buried *B. nebulosus* larvae were suddenly unearthed, they would often begin to run instead of lying motionless in the manner of cryptically-colored myrmeleontid larvae. This atypical behavior increases the resemblance of *B. nebulosus* larvae to mutillid wasps; indeed, both of the larval

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antlions collected were momentarily confused with mutillids when they first appeared. However, at the end of a run, the larvae would stop suddenly and rapidly dig themselves into the sand, completely hiding themselves in about one second. This maneuver might be expected to confuse a predator which had not yet recovered from the initial surprise of the sudden appearance of a "velvet ant". In the laboratory, the larvae of *B. nebulosus* ambushed prey in the manner common to the majority of antlion larvae which do not dig pits by lying in wait, mandibles spread, just beneath the surface of the sand. Prey items were seized as they walked over the mandibles and were dragged backwards until buried.

The abdominal patterns of the three commonest species of mutillid wasps found at the Archbold Station are shown in Fig. 2. *Dasymutilla vesta sappho* (Fox) (Fig. 2, c), which is approximately the size of the last-instar larva of *B. nebulosus*, is the commonest species. The posterior abdomen of this wasp bears conspicuous bands of white hairs set off by dark markings above and below, while the anterior portion of the abdomen, the thorax and the head are a dull reddish-orange. The next most common species, *D. p. pyrrhus* (Fox) (Fig. 2, b), is very brightly colored with shining orange-red hairs on its anterior portions, but the tip of the abdomen bears a conspicuous black region with rings of white fringing hairs around the bases of the last two tergites. *Dasymutilla occidentalis* L. (Fig. 2, c), the largest and least commonly encountered species, lacks white in its color pattern but is brightly marked in shining orange and black bands.

Dasymutilla vesta sappho approaches *B. nebulosus* larvae most closely in size and general appearance, but the reddish-orange coloration of the *B. nebulosus* larvae is more like that of *D. p. pyrrhus*. It is likely that the pattern displayed by *B. nebulosus* is a generalized rather than a specific attempt to simulate the overall mutillid wasp appearance, and that all of the common mutillid wasps of the area may serve as models to a greater or lesser extent. It has been demonstrated that for avian predators, the matching of mimic and model in a Batesian system may lack precision to the degree that the model is punishing (Alcock, 1970; Duncan and Sheppard, 1965). Recently, Terhune (1977) analyzed the components of the visual stimulus used by scrub jays (*Aphelocoma coerulescens*) to discriminate a Batesian model, and found that although color alone was most frequently used to discriminate a model from its mimics, jays also recognized the model on the basis of color and pattern, color and size, or all three components. Coincidentally, the scrub jay is an abundant insect predator at the Archbold Station. This jay frequently forages on the ground, and probably becomes acquainted with the painful stings of mutillid wasps at an early age. Although insufficient *B. nebulosus* larvae were available to perform definitive tests, it is possible that the brightly-colored larvae of *B. nebulosus* gain a measure of protection from scrub jays and

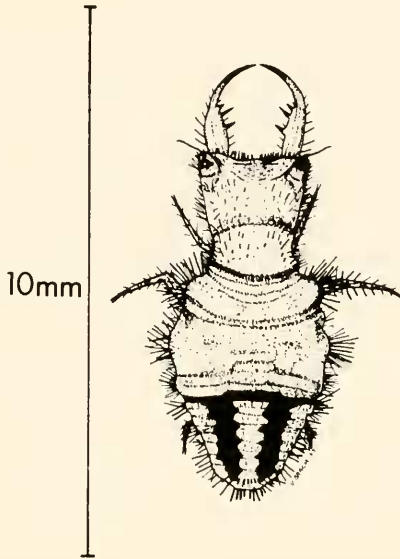


Fig. 1. *Brachynemurus nebulosus* (Oliv.), last-stage larva, dorsal view. The white regions are limited to the posterior abdomen; the color above this is uniformly orange-red.

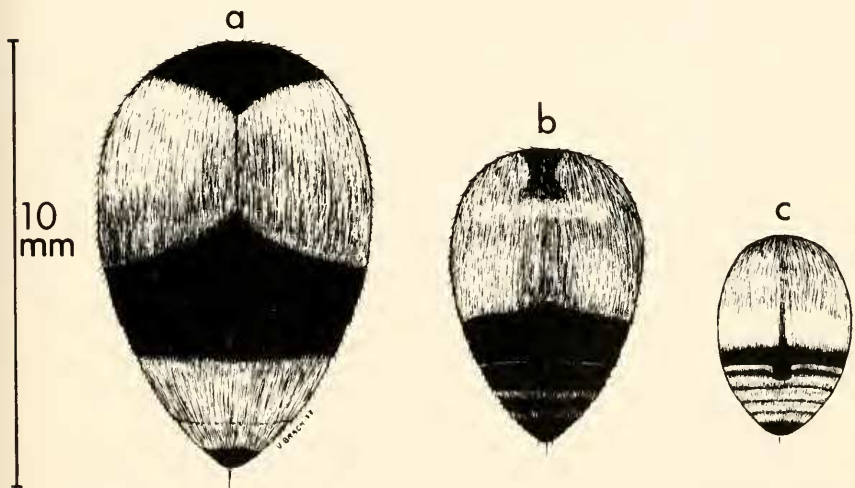


Fig. 2. Abdomens of the three common species of mutillid wasps (females) found at the Archbold Station, Highlands Co., Florida. a) *Dasymutilla occidentalis* L.; b) *D. p. pyrrhus* (Fox); c) *D. vesta sappho* (Fox). The latter two species have bands of white hairs fringing the posterior abdomen; otherwise, the abdominal colors are red or orange and black.

other visual predators by their generalized resemblance, both in appearance and behavior, to several of the mutillid wasps of the region.

ACKNOWLEDGEMENTS

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